Instruction Manual

JOHN FLUKE MFG. CO., INC.

ELECTRONICS FOR INDUSTRY

Model 409A

POWER SUPPLY

INSTRUMENTS / COMPONENTS

John Fluke Manufacturing Co., Inc.
P. O. Box 7428, Seattle 33, Washington

Model 409A

POWER SUPPLY

Serial No. 123 f m

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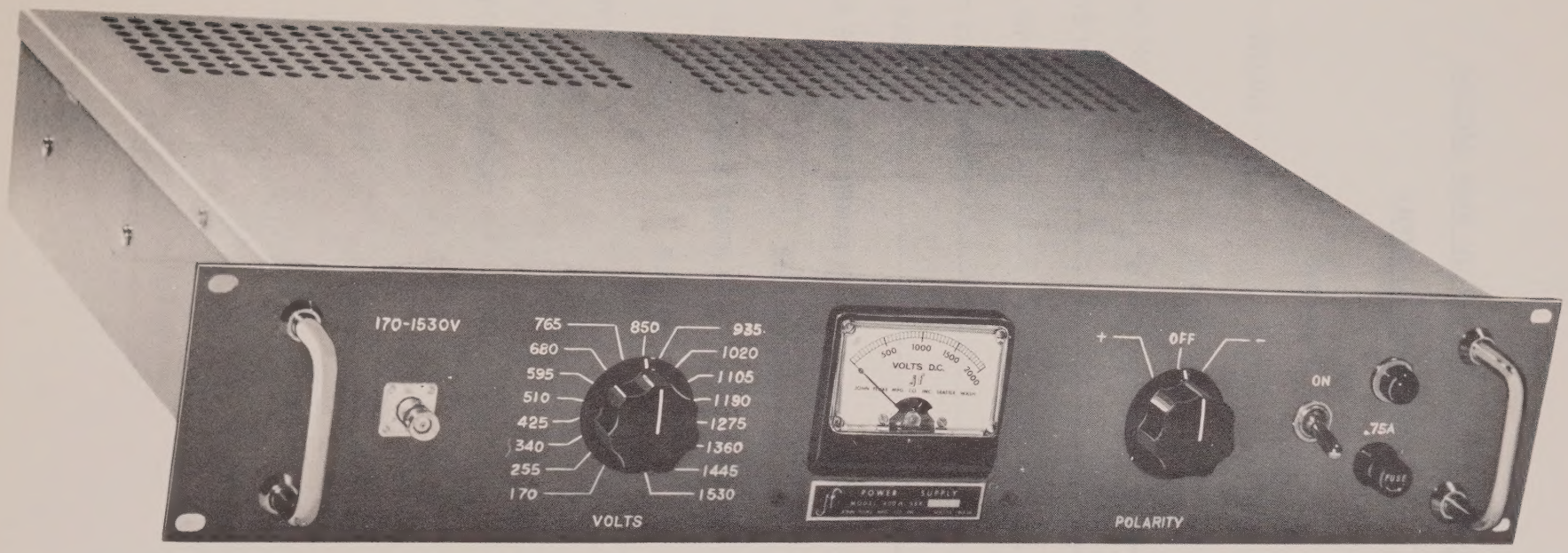
170-1530V
765
680
595
510
425
340
255
170
850
935
1020
1105
1190
1275
1360
1445
1530
VOLTS
500
1000
1500
2000
VOLTS D.C.
POWER SUPPLY
+
OFF
−
POLARITY
ON
.75A
FUSE

MODEL 409A HIGH VOLTAGE DC SUPPLY

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SECTION I.

MODEL 409A
HIGH VOLTAGE NUCLEAR SUPPLY

Electrical Specifications

Input Voltage:	117 volts, 60 cycles, single phase
Input Power:	40 watts
Output Voltage:	170 to 1530 volts
Output Current:	0 to 3 milliamperes over entire voltage range
Output Polarity:	Positive or negative with respect to chassis, selected by front panel switch
Output Connector:	Two type UG931/U - one on panel, one on rear skirt
Regulation vs. Line:	0.01% maximum for 10 volt change in line voltage
Regulation vs. Load:	0.4% maximum for 1 milliampere change
Stability:	0.02% per day after warmup
Ripple:	Less than 0.002% at any output voltage and current in either polarity
Voltage Calibration:	17 - 85 volt steps
Meter:	3 inch with 0-2000 volt scale
Voltage Resettability:	Better than ±0.1%

Mechanical Specifications

Dimensions:	19" wide x 3-1/2" high x 12" deep. Panel slotted to RMA standards. Equipped with handles and removable resilient feet for bench use.
Net Weight:	22 pounds
Shipping Weight:	27 pounds, approximately
Price:	$335.00 FOB factory

SECTION II.

MODEL 409A - HIGH VOLTAGE DC SUPPLY

WARNING - HIGH VOLTAGE

The voltages available in this supply are of lethal magnitude. Extreme care should be exercised in utilizing the output of the Model 409A and in servicing and inspecting it - contact with the high voltage conductors could easily prove fatal. The voltage across C1 is approximately 3,000 volts and similar high voltages are found at several other points in the circuit. BE CAREFUL!

INSPECTION

Before initially operating this supply and immediately upon receipt, inspect for any damage which may have been incurred in transit. If any damage is found, refer to WARRANTY section of this instruction manual and proceed accordingly.

INITIAL OPERATION

Connect supply to a source of 117 volt, 60 cycle power. This supply uses a line voltage regulating transformer which is frequency sensitive. Do not attempt operation at frequencies other than 60 cycles. Set the POLARITY switch to the OFF position and set the voltage selector switch to the desired output voltage. Throw the power switch to ON position. At this point the front panel meter needle should swing upscale somewhat beyond the pre-set value before coming to rest at the desired output voltage. This slight overshoot is characteristic of this type of regulator circuit and is due to the "striking" voltage of a gas discharge tube exceeding its "running" voltage. Now set the POLARITY switch to the desired output polarity. Setting it to "+" makes the center terminal of the output connector positive with respect to the chassis; setting it to "-" makes the center terminal negative with respect to chassis.

Maximum stability of output voltage is attained after approximately an hour's operation. During this time a slight downward drift in the order of a few tenths of a percent will obtain, the major part of which will occur in the first 10 minutes. Under normal room temperature conditions output voltage drift after warmup will be less than .02% per day.

To remove voltage from output connectors, turn POLARITY switch to OFF position.

To change output polarity, turn POLARITY switch to OFF, wait one second and then turn POLARITY switch to desired polarity.

CIRCUIT DESCRIPTION

The Model 409 consists of a line regulating transformer T1 powering a hermetically sealed high voltage transformer T2, the output of which is rectified, filtered and further regulated by a string of eighteen voltage reference tubes, V1 through V18. The rectifiers RE1 through RE16 are hermetically sealed silicon diodes with a peak

inverse rating of 600 volts apiece. The filter capacitors are likewise hermetically sealed units and the resistive part of the filter is made up of conservatively rated deposited carbon 1% resistors. The entire rectifier-filter network is balanced with respect to chassis ground in order to permit maximum attenuation of residual ripple by the regulator tubes. This arrangement results in a stable, jitter-free output with less than .002% of residual ripple under all operating conditions.

The regulator tubes used are the extremely stable type OG3 operated at approximately 5.5 milliamperes. These tubes have an optimum operating range of 1 to 10 milliamperes. The quiescent current of 5.5 milliamperes used in the Model 409 permits a full 3 milliampere output to be drawn and still maintain a tube current in excess of 1 milliampere.

Operated within the 1 to 10 milliampere rating, the OG3 tube has a life expectancy in the order of 10,000 hours. The use of hermetically sealed components at all critical points and the intentional omission of all filamentary type tubes and lamps greatly enhance the use of the Model 409A for applications requiring extreme reliability under conditions of unattended continuous operation.

MAINTENANCE

The design of the Model 409A is such that very little maintenance other than an occasional blowing away of accumulated dust is required. Tube replacement is recommended at the end of 10,000 hours as a precautionary measure.

TROUBLE SHOOTING HINTS

1. BLOWS FUSES - Check for defective filter capacitor. If C2 or C3 are found shorted, check filter resistors R1 through R4 to be sure they have not changed value due to momentary high current.

2. NO OUTPUT - Check for defective rectifier or open filter resistor.

3. EXCESSIVE OUTPUT - If output voltage greatly exceeds pre-set value and/or arcing is noted, check for defective regulator tube. Remove tubes and check on suitable tube tester. Because of the lethal voltages present in this supply, it is not recommended that the defective tube be isolated by connecting a jumper between pins 1 and 5 of each tube in turn.

4. OUTPUT ERRATIC - Check for defective filter resistor or noisy regulator tube.

5. EXCESSIVE RIPPLE - Check for defective C1, C2, and C3 or out-of-tolerance filter resistor R1 through R4.

6. POOR LINE REGULATION - Check value of R5 and R6 and check regulator tubes. Also check action of regulating transformer T1 by checking d-c voltage regulation across C3. This voltage should measure approximately 2080 volts and should change by less than .50% or 10.4 volts for a change in line voltage of 100 to 130 volts. This measurement is best made with a ℱ Model 800 or 801 DC Differential Voltmeter and a 6:1 volt box Model 80-3 for extending range of voltmeter to 3 kv.

7. INABILITY TO DRAW FULL 3 MILLIAMPERES - Check value of resistors R1 through R6. Excessive resistance in filter network will reduce quiescent tube current. Also check for a defective silicon diode RE1-18, open or leaky capacitor C1 through C3, defective high voltage transformer T2 or line regulating transformer T1. The d-c voltage across C3 should be approximately 2080 volts at 117 volts line for any load current between 0 and 3.0 milliamperes.

8. EXCESSIVE DRIFT - If output voltage fails to stabilize after unit is fully warm, trouble is probably one or more defective regulator tubes. This condition may occur toward end of tube life.

SECTION III.

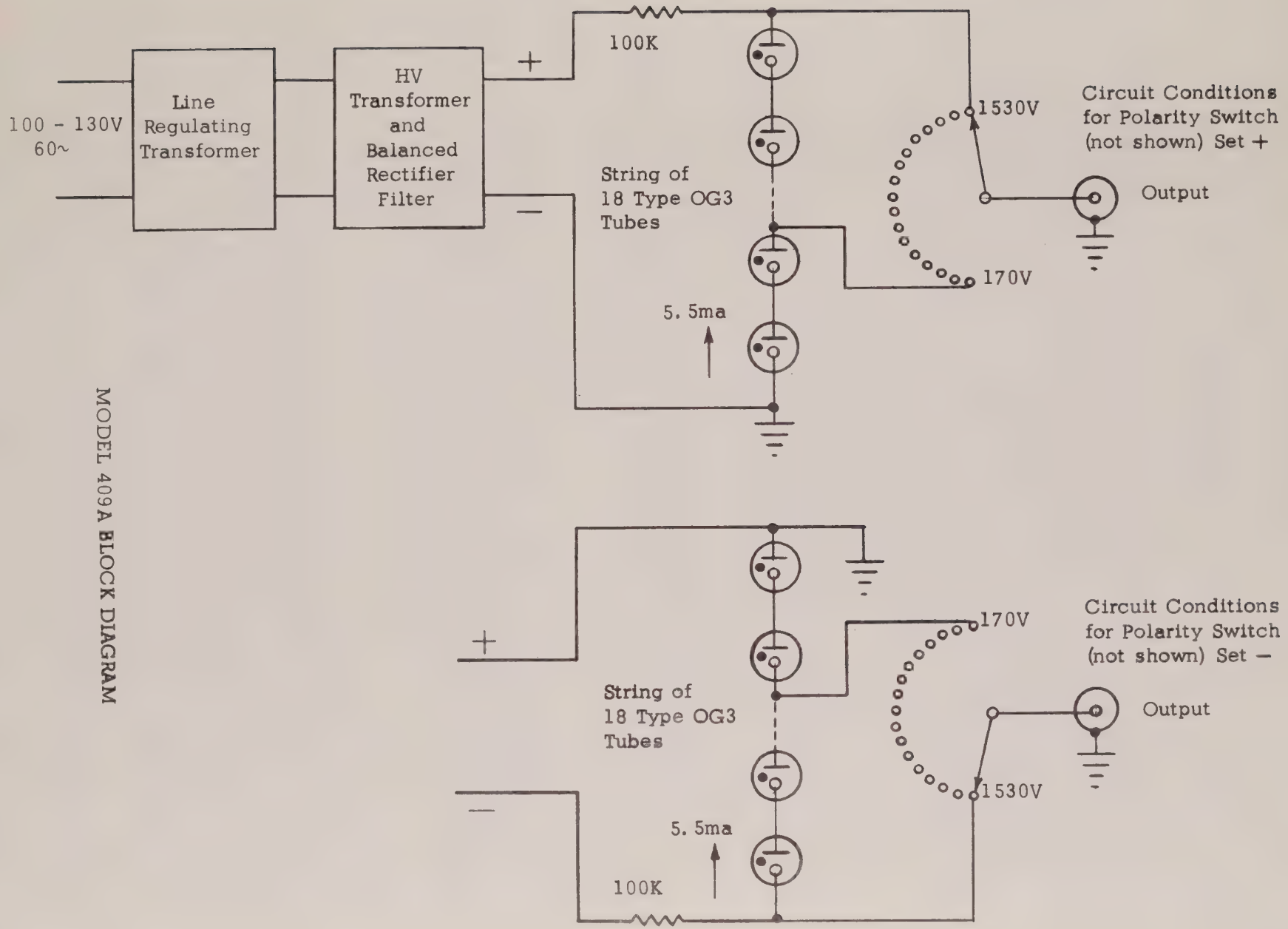
MODEL 409A

LIST OF REPLACEABLE PARTS

CIRCUIT SYMBOL	DESCRIPTION	FLUKE STOCK NO.
C1	Capacitor, plastic film 0.5 mfd, 4 kv	CO19
C2,3	Capacitor, plastic film 0.5 mfd, 3 kv	CO13PNA
C4	Capacitor, plastic film 0.01 mfd, 2 kv	CO7PNA
R1 thru R4	Resistor, deposited carbon 30 k, 1%, 2 w	DR518
R5A,B,C R6A,B,C	Resistor, deposited carbon 300 k, 1%, 2 w	DR628
R7 thru R24	Resistor, composition 1 m, 10%, 0.5 w	EB1051
R25A, B, C, D	Resistor, deposited carbon 2.5 m, 1%, 1 w	DR73
RE1 thru RE16	Rectifier, silicon 500 ma, 600 v, PIV	RE17
S1	Switch, toggle DPST, 3A/250 v	ST1
S2	Switch, rotary 2 pole, 17 position, non-shorting	SR44
S3	Switch, rotary 6 pole, 3 position, non-shorting	SR7
T1	Transformer, line regulating, 40 w	VR1

CIRCUIT SYMBOL	DESCRIPTION	FLUKE STOCK NO.
T2	Transformer, high voltage	409-601
V1 thru V18	Tube, voltage reference	OG3/85A2
M1	Meter, 0-200 microamp. with special 2.0 kv scale	M27
	Fuse holder	X12
	Connector, output, female UG 931/U	X23
	Connector, output, male UG 932/U	X112
	Pilot light, neon	X25
	Adapter, line cord plug	X27B
	Line cord, 3-18	X27D
	Handles, front panel	X56
	Handle, ferrule	X58
	Bushing, strain relief	X138
	Fuse, .75 amp., slow blow	X193
	Knob, 1-1/2" pointer	X234
	Foot, rubber mounting	X224

SECTION IV.



MODEL 409A BLOCK DIAGRAM

WARRANTY

The JOHN FLUKE MFG. CO., INC. warrants each instrument manufactured by them to be free from defects in material and workmanship. Their obligation under this Warranty is limited to servicing or adjusting an instrument returned to the factory for that purpose, and to making good at the factory any part or parts thereof; except tubes, fuses, choppers and batteries, which shall, within one year after making delivery to the original purchaser, be returned by the original purchaser with transportation charges prepaid, and which upon their examination shall disclose to their satisfaction to have been thus defective. If the fault has been caused by misuse or abnormal conditions of operation, repairs will be billed at a nominal cost. In this case, an estimate will be submitted before work is started, if requested.

If any fault develops, the following steps should be taken.

1. Notify the John Fluke Mfg. Co., Inc., giving full details of the difficulty, and include the Model number, type number, and serial number. On receipt of this information, service data or shipping instructions will be forwarded to you.

2. On receipt of the shipping instructions, forward the instrument prepaid, and repairs will be made at the factory. If requested, an estimate of the charges will be made before the work begins, provided the instrument is not covered by the Warranty.

SHIPPING

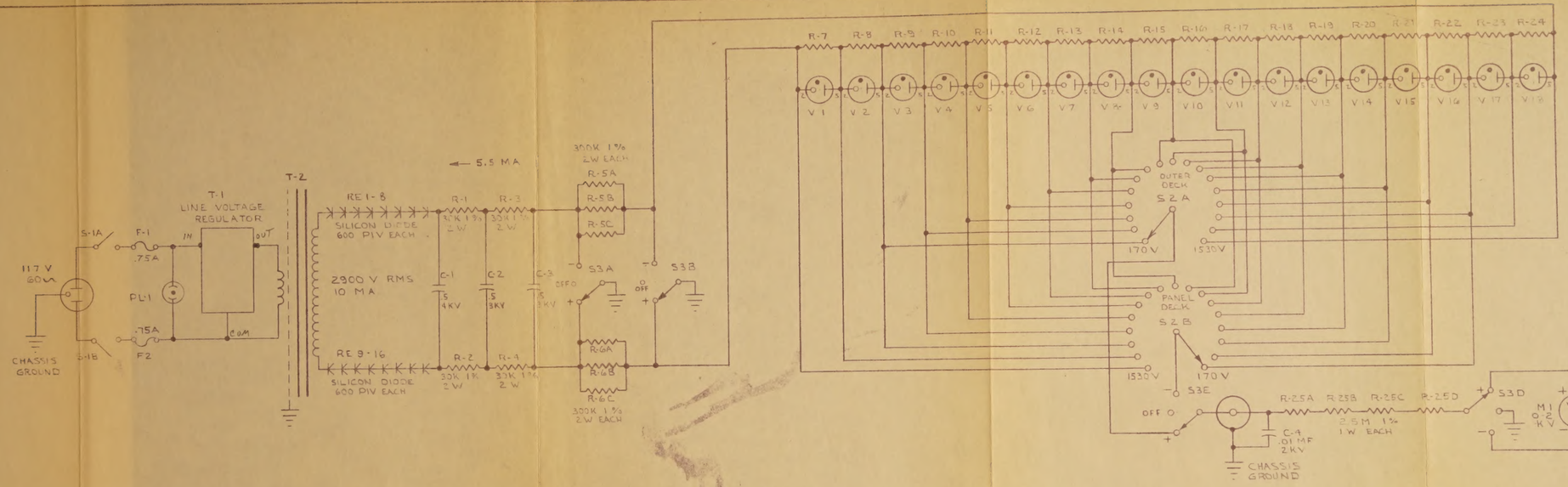
All shipments of John Fluke Mfg. Co., Inc. instruments should be made via Railway Express prepaid. The instrument should be shipped in the original packing carton; or if it is not available, use any suitable container that is rigid. If a substitute container is used, the instrument should be wrapped in paper and surrounded with at least four inches of excelsior or similar shock-absorbing material.

CLAIM FOR DAMAGE IN SHIPMENT

The instrument should be thoroughly inspected immediately upon receipt. All material in the container should be checked against the enclosed packing list. The manufacturer will not be responsible for shortages against the packing sheet unless notified immediately. If the instrument fails to operate properly, or is damaged in any way, a claim should be filed with the carrier. A full report of the damage should be obtained by the claim agent, and this report should be forwarded to John Fluke Mfg. Co., Inc. Upon receipt of this report you will be advised of the disposition of the equipment for repair or replacement. Include the model number, type number, and serial number when referring to this instrument for any reason.

The John Fluke Mfg. Co., Inc. will be happy to answer all application questions which will enhance your use of this instrument. Please address your requests to:

JOHN FLUKE MFG. CO., INC., P. O. BOX 7428, SEATTLE 33, WASHINGTON



S1 : POWER SWITCH
S2 : VOLTAGE SELECTOR SWITCH
S3 : POLARITY SWITCH
V1-V18 6SA7 / 0G3 TUBE
R7-R24 : 1 MEG, 10 %, .5W

SEE 120 A ABOVE

JOHN FLUKE MFG. CO. INC
SEATTLE, WASH.

CIRCUIT DIAGRAM

MODEL 409A | DWG NO 409A-101

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